REMEDIAL INVESTIGATION REPORT

for

BROOME STREET PARKING LOT SITE
New York, New York
NYSDEC BCP Site No. C231137

Draft

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CERTIFICATION

I, Christopher McMahon, certify that I am currently a Qualified Environmental Professional as defined in 6 New York Codes, Rules, and Regulations Part 375 and that this Remedial Investigation Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

Christopher McMahon, CHMM

1.0 INTRODUCTION

On behalf of GO Broome LLC (the Volunteer), Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan), has prepared this Remedial Investigation (RI) Report for the ±0.54-acre property located to the southwest of the intersection of Broome Street and Suffolk Street (Block 346, Lot 75) (Figure 1), in the Lower East Side section of Manhattan, New York (hereinafter the "Site"). GO Broome LLC is participating in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) as a Volunteer as defined in ECL 27-1405 (1)(b) and as identified in the executed Brownfield Cleanup Agreement dated 2 January 2020. The Site is identified in the BCP as Site No. C231137.

The RI was conducted in accordance with the NYSDEC-approved 22 July 2020 Remedial Investigation Work Plan (RIWP) prepared by Langan. The investigation was completed to further characterize and delineate contamination at the Site based on the DEC's comments provided in the 4 March 2020 and 22 April 2020 letters from DEC Project Manager Meghan Medwid of the Division of Environmental Remediation. This investigation supplements the findings of the May 2019 Remedial Investigation Report and was conducted in accordance with the process and requirements identified in the NYSDEC Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation (May 2010) and the New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006).

2.0 SITE DESCRIPTION

2.1 Physical Setting

The Site is located in the Lower East Side section of Manhattan, New York and is identified as Block 346 Lot 75. A Site Location Plan is provided as Figure 1. The Site is an approximately 23,960-square foot parcel or 0.54 acres bound to the north by Broome Street followed by an at-grade parking facility, to the east by Suffolk Street followed by a mixed-use property with an asphalt-paved parking area, to the south by a five-story mixed-use building, and to the west by the 14-story Hong Ning Housing for the Elderly building and the former Beth Hamedrash Hagodol Synagogue which was demolished in June 2020. The Site contains asphalt paved parking, a concrete patio, and landscaped areas.

2.2 Site Stratigraphy and Hydrogeology

According to the Boundary and Topographic Survey prepared by Langan dated 29 December 2017, last revised 14 May 2018, the Site slopes gently downward from the northeast (elevation el 31.5) to the southwest (elevation el 33.7). All elevations are North American Vertical Datum of 1988 (NAVD 88).

Based on the findings of the Remedial Investigation (RI) work completed by Langan, the Site is underlain by historic fill that ranges from approximately 11.5 feet thick in the central portion (LSB-10) to approximately 30 feet thick in the northeast portion (LSB-4), where the base of the fill was not encountered prior to the boring termination depth of 30 feet below grade. The base of the fill layer was also not encountered prior to the boring termination depth of 20 feet below grade in LSB-7, located in the southeast portion of the Site, LSB-19 and LSB-20 located in the northwestern portion of the Site, and in LSB-9 and LSB-28, completed in the north-central portion of the Site. The historic fill layer consists of light brown to brown and red brown sand with varying amounts of brick, gravel, concrete, wood, and silt. Native sand was encountered in all soil borings, with exception of soil borings LSB-7, LSB-19, LSB-20, LSB-9, and LSB-28 (completed to 20 feet below grade as noted above) and LSB-4 (completed to 30 feet below grade in the northeast portion of the Site).

According to the Preliminary Geotechnical Investigation completed by Langan in February 2019, subsurface conditions consist of miscellaneous fill underlain by a 9 to 25 foot thick upper sand unit, a 20 to 60 foot silt stratum, followed by a lower sand unit. Bedrock was not encountered in any of the geotechnical borings, which were advanced to depths that ranged from 77 to 102 feet below sidewalk grade.

Monitoring wells installed during the 2020 RI revealed groundwater between 22.65 and 27.54 feet below Site grade, corresponding to elevations 5.35 – 8.93 NAVD88 in LMW-7 through LMW-12. Based on the groundwater elevations recorded during the 2020 RI, groundwater flows to the south.

Langan reviewed United States Fish and Wildlife National Wetland Inventory (NWI) and New York State Freshwater Wetlands maps. Based on these documents no mapped wetlands are listed on the subject property.

2.3 Surrounding Property Land Use

According to records maintained online by New York City Open Accessible Space Information System (NYCOASIS) and aerial/street-view observations provided by Google Maps, surrounding properties include multi-story mixed-use residential/commercial buildings and parking lots. The following is a summary of adjacent property usage:

Direction	Adjacent Properties		
	Block No.	Lot No.	Description
North	346	150	Broome Street followed by a site currently under development (145 Clinton Street)
East	346	39	Suffolk Street followed by a vacant lot
	346	7501	Suffolk Street followed by one 15-story mixed-use residential/commercial building (145 Clinton Street)
South	346	95	A five-story missed-use residential/commercial building (384 Grand Street)
West	346	1	A 14-story Hong Ning Housing for the Elderly building (50 Norfolk Street)
	346	37	The former one-story Beth Hamedrash Hagodol Synagogue (60 Norfolk Street) [demolition completed in June 2020]
	351	1	Norfolk Street followed by three 23-story mixed-use residential/commercial buildings (62 Essex Street)

Public infrastructure (storm drains, sewers, and underground utility lines) exists within the streets surrounding the Site. Sensitive receptors, as defined in DER-10, located within a half-mile of the Site, and which will receive Fact Sheets related to the project translated into both Chinese and Spanish, include those listed below:

Number	Name (Approximate distance from site)	Address
1	Hong Ning Housing for the Elderly (located adjacent to the southwest of the site)	50 Norfolk Street New York, NY 10002
2	Seward Park HS (approximately 0.1-miles west of the site)	350 Grand Street New York, NY 10002
3	PS 042 Benjamin Altman (approximately 0.2-miles west-southwest of the site)	71 Hester Street New York, NY 10002
4	Cmsp-Marte Valle Sec. School (approximately 0.2-miles north of the site)	145 Stanton Street New York, NY 10002
5	PS 142 Amalia Castro (approximately 0.2-miles northeast of the site)	100 Attorney Street New York, NY 10002
6	PS 140 Nathan Straus (approximately 0.25-miles northeast of the site)	123 Ridge Street New York, NY 10002
7	PS 134 Henrietta Szold (approximately 0.25-miles southeast of the site)	293 East Broadway New York, NY 10002
8	JHS 056 Corlears (approximately 0.25-miles south-southeast of the site)	220 Henry Street New York, NY 10002
9	PS 002 Meyer London (approximately 0.3-miles southwest of the site)	122 Henry Street New York, NY 10002
10	I S 131 (approximately 0.3-miles west of the site)	100 Hester Street New York, NY 10002
11	PS 020 Anna Silver (approximately 0.3-miles north of the site)	166 Essex Street New York, NY 10002
12	University Neighborhood H.S. (approximately 0.35-miles southeast of the site)	200 Monroe Street New York, NY 10002
13	PS 137 John L Bernstein (approximately 0.4-miles south-southeast of the site)	327 Cherry Street New York, NY 10002
14	New Explorations Sci, Tech, Math (approximately 0.4-miles northeast of the site)	111 Columbia Street New York, NY 10002
15	PS 110 Florence Nightingale (approximately 0.4-miles east of the site)	285 Delancy Street New York, NY 10002
16	PS 124 Yung Wing (approximately 0.45-miles west-southwest of the site)	40 Division Street New York, NY 10002

2.4 Historical Site Usage

According to the Phase I ESA completed by Langan in November 2017, historical use and features of the Site included printing, a coppersmith and tinsmith, and two laundry services. The presence of historic urban fill and the deteriorated remains of former onsite buildings in the subsurface was identified as a Business Environmental Risk (BER), as this material is typically characterized by elevated concentrations of polycyclic-aromatic hydrocarbons (PAHs) and metals. Historical Site operations including printing, metalsmithing, and laundry services were identified as a Recognized Environmental Condition (REC) due to the potential use of chemicals associated with these operations and the duration of the activities. Current and historical operations conducted at adjacent and nearby properties involving the use of ASTs, USTs, spills, and the generation and disposal of hazardous waste.

3.0 PROPOSED REDEVELOPMENT PLAN

The planned Site redevelopment consists of a multi-story mixed-use partially affordable housing building with a full cellar. The proposed building will contain mechanical and residential and retail storage spaces and a locker room and break room in the cellar and a ground-floor residential lobby, retail spaces, and community space. The second and third floors will be used for community facility spaces and the fourth through thirtieth floors will be occupied by apartments and amenities. Residential units will include 25% permanent affordable housing.

Excavation will be completed as part of the planned Track 2 restricted residential remediation of the Site to elevation 14 NAVD88 (corresponding to a depth of approximately 18 feet below street level) across the entire Site footprint. Excavation depths and design drawings will be provided in the Remedial Action Work Plan (RAWP). Remediation of the Site will be completed in accordance with the forthcoming RAWP subsequent to the approval of this Remedial Investigation Report.

4.0 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AND REPORTS

The following environmental assessment and investigation reports have been prepared for the site.

- Phase I Environmental Site Assessment prepared by Langan, dated 27 November 2017;
- Remedial Investigation Report prepared by Langan, dated 7 May 2019;
- Draft Phase 1B Archaeology Workplan prepared by VHB Engineering, Surveying, Landscape Architecture, and Geology, P.C. (VHB), dated November 2019;
- Interim Remedial Measures Work Plan prepared by Langan, dated January 2020; and
- Remedial Investigation Work Plan prepared by Langan, dated July 2020.

November 2017 Phase I Environmental Site Assessment, prepared by Langan

A Phase I Environmental Site Assessment (ESA) dated November 2017 was prepared for the Site and the adjacent Lot 37. This Phase I ESA identified the following recognized environmental condition (RECs) and business environmental risks (BERs) associated with the Site:

1. Historical Site operations including printing, metalsmithing, and laundry services were identified as a REC due to the potential use of chemicals associated with these operations and the duration of the activities.
2. The presence of historic urban fill or the deteriorated remains of former onsite buildings in the subsurface was identified as a BER, as this material is typically characterized by elevated concentrations of PAHs and metals.
3. Potential impacts from current and historical operations conducted at adjacent and nearby properties involving the use of ASTs, USTs, spills, and the generation and disposal of hazardous waste was identified as a BER due to the potential for offsite migration of contaminants to impact sub-slab soil and/or groundwater below the subject site.

May 2019 Remedial Investigation Report, prepared by Langan

A Remedial Investigation Report (RIR) dated 17 May 2019 was prepared by Langan for GO Broome LLC. The RI was completed to investigate potential impacts to the soil and groundwater at the site associated with the RECs or BERs as identified in the Phase I ESA.

The scope of work included:

- Completion of a geophysical investigation;
- Completion of eight soil borings and collection of seventeen soil samples (two samples from each boring plus a one duplicate sample) to assess soil conditions;
- Installation and sampling of four monitoring wells in order to collect groundwater samples to assess current site groundwater conditions; and,

- Installation and sampling of seven soil vapor points in order to assess current site soil vapor conditions.
- Completion of eight additional soil borings in conjunction with the RI for the collection of composite soil samples in 5-foot intervals from 0 to 20 feet below ground surface in order to assess waste disposal options.

A total of 16 discrete soil samples, 20 composite waste characterization soil samples, four groundwater samples, and seven soil vapor samples were collected and submitted for laboratory analysis. Summaries of the laboratory analytical results for soil, groundwater, and soil vapor sampling completed as part of this investigation are provided in Tables 1A, 1B, 2, and 3 provided in Appendix H and on Figures 6A, 6B, 7, and 8. Copies of the boring logs completed as part of this investigation are provided in Appendix H.

Discrete soil samples were collected from 0 to 2 feet below grade and from 18 to 20 feet below grade (corresponding to the interval immediately beneath the proposed excavation). All soil analytical results were compared to the NYSDEC 6 NYCRR Subpart 375-6.8(a-b) Remedial Program Soil Cleanup Objectives (SCOs) (herein referred to as the NYSDEC SCOs). No exceedances of the Unrestricted Use SCOs were detected in any of the soil samples collected for VOCs or PCBs.

Exceedances of the Unrestricted Use SCOs were detected in shallow samples included the pesticides 4,4'-DDD, 4,4'-DDE, 4'4,-DDT, and dieldrin in six of the eight shallow soil samples and metals hexavalent chromium, copper, lead, mercury, and zinc in all eight shallow samples collected. The polycyclic aromatic hydrocarbon (PAH), which is commonly associated with the presence of historic fill, benzo(k)fluoranthene was detected above the Unrestricted Use SCOs in one shallow sample.

Polycyclic aromatic hydrocarbons (PAHs) including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which are commonly associated with the presence of historic fill, were identified in six of eight shallow soil samples collected at concentrations exceeding the Restricted Residential Restricted Use SCOs (RUSCOs). Metals including barium, cadmium, lead, and mercury were detected in four of eight shallow soil samples at concentrations above the Restricted Residential and/or Commercial RUSCOs.

Exceedances of the Unrestricted Use SCOs for PAHs were not detected in any deep soil samples collected from 18 to 20 feet bgs. However, deep soil samples collected from the deeper historic fill areas on the Site revealed concentrations of 4,4'-DDT, nickel, lead, zinc, and mercury at concentrations exceeding the Unrestricted Use SCOs in three of eight

samples. No exceedances of the Restricted Residential RUSCOs were detected in any of the deep samples collected.

Due to the depth to groundwater ranging from 22.65 to-27.54 feet below grade, groundwater monitoring wells were installed within the native material, with the exception of LMW-4 where the bottom of the historic fill layer was not encountered. Analytical results revealed no VOCs, SVOCs, Pesticides, or PCBs were detected in exceedance of the NYSDEC GWQS. Total metals including selenium, sodium, iron, and manganese and dissolved metals including sodium, selenium, and manganese were detected in groundwater at concentrations exceeding the NYSDEC GWQS. PAHs were not detected in groundwater monitoring wells at concentrations exceeding the GWQS; however, laboratory reporting limits for these compounds ranged from 0.0541 µg/l to 0.0625 µg/l, which are above the GWQS of 0.002 µg/l for these compounds. Based on the absence of PAHs in groundwater samples collected at the Site, historic fill impacts identified in the shallow soils have not impacted the groundwater at the Site. As discussed below, all laboratory analytical results were validated and determined to be usable. Data usability summary reports are provided in Appendix F.

The VOCs acetone, methylene chloride and toluene were detected in soil samples at concentrations below the Unrestricted Use SCOs and the VOCs acetone, chloroform, and tetrachloroethene (PCE) were detected in groundwater, but at concentrations below the GWQS. Low levels of these VOCs were also detected in soil vapor samples. Additionally, VOCs detected in soil vapor at the Site, which are those included in the NYSDOH Soil Vapor/Indoor Air Decision Matrices A through C, included carbon tetrachloride, methylene chloride, PCE, and trichloroethene (TCE). None of these VOCs were detected at concentrations that require additional investigation, monitoring, or mitigation according to the NYSDOH Final Guidance on Soil Vapor Intrusion, October 2006. Petroleum related VOCs benzene, toluene, ethylbenzene and xylenes (collectively referred to as BTEX) were detected in soil vapor samples; however, as these compounds were not detected in soil or groundwater samples, these soil vapor detections are attributed to regional soil vapor impacts and not related to a historical on-Site petroleum release.

During the 2019 Remedial Investigation activities, Langan collected composite waste characterization samples concurrently with the discrete Remedial Investigation samples. A total of 20 composite soil samples (WC 1A/B/C/D through WC-5A/B/C/D) and one blind duplicate sample were collected from 0 to 5 feet bgs, 5 to 10 feet bgs, 10 to 15 feet bgs, and 15 to 20 feet bgs for laboratory analysis, and the results were screened against the NYSDEC SCOs. The waste characterization soil analytical results revealed exceedances of the NYSDEC Unrestricted and Restricted Residential RUSCOs throughout the Site.

The 2019 RI and waste characterization investigation revealed that pesticide, metal, and SVOC concentrations exceeding the Unrestricted Use SCOs are present in the deeper areas of historic fill greater than 18 feet bgs such that a Track 1 remedy is not feasible; as such, a Track 2 remedy will be proposed in the RAWP. While there were no exceedances of the Unrestricted Use SCOs detected for PCBs or herbicides, and no exceedances of the Unrestricted Use SCOs detected for VOCs in any of the soil samples collected with the exception of acetone in one sample from 0 to 5 feet bgs, pesticides exceeding the Unrestricted Use SCOs were detected in 14 of the 20 samples collected between 0 and 20 feet bgs including 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin as follows: in all five samples collected between 0 and 5 feet, four of the samples collected between 5 to 10 feet, three of the samples collected between 10 and 15 feet; and two of the samples collected between 15 and 20 feet.

SVOCs are also present above the Unrestricted Use SCOs between 15 and 20 feet bgs. SVOCs exceeding the Unrestricted Use SCOs were detected in 9 of the 20 samples collected between 0 and 20 feet bgs including benzo(k)fluoranthene and chrysene. SVOCs were detected above the NYSDEC Unrestricted Use SCOs in three samples collected from between 0 and 5 feet bgs, three samples collected from 5 to 10 feet bgs, four of the samples collected from 10 to 15 feet bgs, and one of the samples collected from 15 to 20 feet bgs.

Similarly, metals exceeding the NYSDEC Unrestricted Use SCOs were detected in 17 of the 20 samples collected between 0 and 20 feet bgs including barium, copper, lead, mercury, nickel, and zinc. Metals were detected above the NYSDEC Unrestricted Use SCOs in all five samples collected from between 0 and 5 feet bgs, all five samples collected from 5 to 10 feet bgs, four of the samples collected from 10 to 15 feet bgs, and three of the samples collected from 15 to 20 feet bgs.

Restricted Residential RUSCOs exceedances were also detected between 15 and 20 feet bgs. While there were no exceedances of the Restricted Residential RUSCOs detected for VOCs, PCBs, or herbicides, SVOCs exceeding the Restricted Residential RUSCOs were detected in 12 of the 20 samples collected between 0 and 20 feet bgs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd) as follows: in all five samples collected from 0 to 5 feet bgs, three of the samples collected from 5 to 10 feet bgs, four of the samples collected from 10 to 15 feet bgs, and one sample collected from 15 to 20 feet bgs. In addition, metals exceeding the Restricted Residential RUSCOs were detected in 12 of the 20 samples collected between 0 and 20 feet bgs including barium, lead, and zinc as follows: in all five of the samples collected between 0 and 5 feet, three of the samples collected between 5 to 10 feet

bgs, three of the samples collected between 10 and 15 feet, and one of the samples collected between 15 and 20 feet.

May 2019 Remedial Investigation Data Usability Summary Reports (DUSRs)

As requested by NYSDEC, DUSRs were prepared for data collected during the previous investigation and are included herein. The DUSRs were prepared in accordance with DER-10 and reviewed by Langan's in-house validator before issuance. The DUSRs presented the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of deficiencies for each analytical method. DUSRs for the RI are provided in Appendix F.

All data are considered usable, as qualified. Some data qualifiers were appended to the reported results, which have been included in the respective data summary tables (Tables 1A through 3 in Appendix H). Copies of the DUSRs are included in Appendix F.

November 2019 Draft Phase 1B Archaeology Workplan, prepared by VHB

A Draft Phase 1B Archaeology Workplan dated November 2019 was prepared by VHB for GO Broome LLC. The Phase 1B Workplan was prepared in order to describe procedures for the investigation of the historical land use of the Site as previously identified in their January 2019 Phase 1A Archaeological Documentary Study. The Phase 1A concluded that portions of the Site have a moderate to high sensitivity for the presence of 19th Century archaeological features. As such, VHB prepared a Phase 1B Workplan to investigate for the presence or absence of archaeological materials on Site.

January 2020 Interim Remedial Measures Work Plan, prepared by Langan

An Interim Remedial Measures (IRM) Work Plan dated January 2020 was prepared by Langan for GO Broome LLC. The IRM Work Plan was prepared to describe the procedures for conducting an archaeological investigation described in the Draft Phase 1B Archaeology Workplan discussed above in support of the ULURP and CEQR process and geotechnical investigations at the Site. As part of the investigation soil trenching and test pits will be installed at locations throughout the Site which will result in soil disturbance. No remedial activities were proposed as part of the IRM Work Plan; however, contingencies were provided to address unforeseen contamination that may be discovered during the soil disturbance activities, including removal of grossly and/or petroleum-impacted soil hotspots and closure

of any underground storage tanks (USTs) encountered during soil disturbance activities, in advance of implementation of a RAWP for the redevelopment of the site.

July 2020 Remedial Investigation Work Plan, prepared by Langan

A Remedial Investigation Work Plan dated 22 July 2020 was prepared by Langan for GO Broome LLC. The RIWP was prepared to investigate and characterize "the nature and extent of the contamination at and/or emanating from the brownfield site," per ECL Article 27, Title 14 (Brownfield Cleanup Program) and to supplement the investigation activities and results documented in the May 2019 Remedial Investigation (RI) Report.

The scope of work for the RI presented in the RIWP consisted of:

- A limited ground-penetrating radar (GPR) survey within the vicinity of soil boring locations to investigate the location of subsurface utilities;
- Advancement of ten soil borings (LSB-19 through LSB-28) and collection of 43 soil samples (including two duplicate samples);
- Collection of 12 surficial soil samples (including one duplicate sample) from 11 surficial soil sampling locations (LSS-1 through LSS-11)
- Installation of six permanent monitoring wells (LMW-7 through LMW-12) and collection of six groundwater samples (including one duplicate sample) from LMW-7 through LMW-10 and LMW-12;
- Survey and gauging of monitoring wells to evaluate groundwater elevation and flow direction; and,
- Installation of nine soil vapor sampling points (LSV-10 through LSV-18) and collection of ten soil vapor samples (including one duplicate sample) and one ambient sample.

5.0 SUMMARY OF AREAS OF CONCERN

Based on Site observations, the Site development history, and the findings of the previous environmental reports, AOCs were identified and investigated during the previous environmental investigations and are described in detail below. AOC locations are provided on Figure 5.

AOC 1: Historic Fill

Material from unknown sources was used as backfill during various phases of the Site development history. Historical soil sample analytical results exceeding the Unrestricted Use SCOs and Restricted Residential RUSCOs for SVOCs, pesticides, and metals were detected throughout the Site in discrete shallow soil samples (0 to 2 feet bgs) and in composite waste characterization soil samples (0 to 5 feet, 5 to 10 feet, 10 to 15 feet, and 15 to 20 feet). The

historic fill was visually observed to range from approximately 11.5 feet thick in the central portion (LSB-10) to approximately 30 feet thick in the northeast portion (LSB-4), where the base of the fill was not encountered prior to the boring termination depth of 30 feet below grade, and predominantly consisted of light brown to brown and red brown sand and varying amounts of brick, gravel, concrete, wood, and silt.

AOC 2: Historical Site Use

Operations of concerns were historically located along the northern and eastern frontage of the Site including printing between 1905 and 1950, a coppersmith and tinsmith (1920), and laundry services (1922, 1947-1968). Potential releases of petroleum products, solvents, and/or other hazardous materials associated with these prior uses may have adversely affected soil, groundwater and/or soil vapor.

6.0 REMEDIAL INVESTIGATION

The 2020 RI was completed to supplement findings and further investigate the impacts identified in the May 2019 RI and address the requirements for additional investigation and reporting provided in the 4 March 2020 and 22 April 2020 NYSDEC letters. These requirements were subsequently addressed in the NYSDEC-approved 22 July 2020 RIWP prepared by Langan.

The objectives of the RI included:

- Supplementing the investigation activities and results provided in the 2019 Remedial Investigation Report;
- Determining if a source area in soil or groundwater exists;
- Confirming the assumed groundwater flow direction;
- Characterizing the nature and vertical and lateral extents of the impacts in soil and groundwater;
- Based on the groundwater flow direction and groundwater analytical results, determining if groundwater impacts are confined within the Site boundaries or have the potential to migrate off-Site; and,
- Determining if a vapor intrusion condition exists that would require mitigation.

The results of the geophysical survey are discussed in Section 6.1. Soil, groundwater, and soil vapor sampling procedures are discussed in Sections 6.2, 6.3, and 6.4, respectively. Quality assurance procedures implemented during this investigation and data validation

(Data Usability Summary Reports [DUSRs]) that were completed are discussed in Section 6.5 and results of soil, surficial soil, groundwater, and soil vapor sampling are discussed in Section 6.6. The locations of all soil, surficial soil, groundwater, and soil vapor samples collected during this investigation are shown on Figure 5. A summary of the laboratory analytical data provided for this investigation are summarized in Tables 2 through 4 and are shown on Figures 9 through 11. All samples were analyzed by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. Daily Reports of work performed are provided in Appendix G.

6.1 Geophysical Survey Investigation

A limited geophysical survey was completed by Hager-Richter Geoscience, Inc. of Fords, New Jersey using electromagnetic surveying equipment (i.e., the Radiodetection RD 7000 series precision utility location [PUL] instrument) and ground penetrating radar (i.e., the Geophysical Survey Systems, Inc. UtilityScan HS system). The purpose of the geophysical survey was to provide utility clearance for the investigation. A copy of the geophysical investigation report is provided in Appendix A.

The geophysical survey identified the presence of linear reflections typical of subsurface utilities or segments of subsurface utilities. Electrical and drainage subsurface utilities were identified within the vicinity of boring locations. Subsurface metallic anomalies consistent with the presence of USTs were not identified within the geophysical survey area during this investigation.

6.2 Soil Investigation

Ten soil borings (LSB-19 through LSB-28) and eleven surficial soil sample locations (LSS-1 through LSS-11) were completed by AARCO Environmental Services Corp. of Lindenhurst, New York (AARCO).

Soil borings were completed for the purpose of completing the Site-wide characterization and/or delineation of previously collected 2019 RI waste characterization samples. Soil borings completed for the purpose of Site-wide characterization were completed to 22-ft bgs and soil borings completed for the purpose of delineating previous waste characterization samples were completed to depths corresponding to the previously identified impacted intervals. Surface soil samples were collected from 0 to 2 inches bgs for the purpose of assessing impacts to surface soil.

A sampling plan identifying the location, depth and sampling rationale for the completed borings is provided in Table 1 and boring locations are shown on Figure 5. Subsurface profiles are provided in Figures 2A and 2B.

6.2.1 Soil Boring Investigation Methodology

Soil borings were completed by using a GeoProbe®7822DT track-mounted direct push drill rig (LSB-19 through LSB-21 and LSB-24 through LSB-28) and a GeoProbe®6610DT track-mounted direct push drill rig (LSB-22 and LSB-23). Soil borings LSB-25 and LSB-26 were completed to approximately 15 feet bgs; soil borings LSB-19, LSB-20 and LSB-28 were completed to approximately 20 feet bgs; and soil borings LSB-21 through LSB-24 and LSB-27 were completed to approximately 22 feet bgs. Soil borings were completed for the purpose of Site-wide characterization and/or delineation of previously collected waste characterization samples as described below:

- LSB-19 was completed to delineate impacts to the north of both WC-4 and WC-5.
- LSB-20 was completed to delineate impacts to the west of both WC-4 and WC-5.
- LSB-21 was completed to delineate impacts to the north of WC-3 and to the east and south of both WC-4 and WC-5, in addition to further investigating potential impacts from the former printer operations.
- LSB-22 was completed to delineate impacts to the south and east of WC-3 in addition to further investigating potential impacts from the former printer operations.
- LSB-23 was completed to delineate impacts to the west of WC-3 in addition to further investigating potential impacts from the former printer operations.
- LSB-24 was completed to delineate impacts to the south of WC-1 and WC-2 in addition to site-wide characterization.
- LSB-25 was completed to delineate impacts to the north and east of WC-1.
- LSB-26 was completed to delineate impacts to the west of both WC-1 and WC-2.
- LSB-27 was completed to delineate impacts to the south of WC-1 in addition to site-wide characterization.
- LSB-28 was completed to delineate impacts to the east of WC-2 and to the west of WC-3.

Discrete soil samples were collected from the surface to the final depth of each boring and were visually classified for soil type, grain size, texture, and moisture content. At the locations completed with the direct push drill rig, continuous macrocore samples were collected in 5-foot long acetate liners to the bottom of each boring. Soil cuttings exhibiting no gross impacts were placed back into boreholes after completion of the investigation.

Field screening of soil during sample collection for VOCs using a field calibrated PID equipped with a 10.6-electron volt (eV) lamp was completed during the installation of all ten test borings. PID readings of 0.1 to 0.7 ppm above background were observed in LSB-19 and LSB-21 and readings of 0.1 above background were observed in LSB-20 and LSB-22. No PID readings above background were measured in LSB-23 through LSB-28. Petroleum-like impacts, as evidenced by odors, staining, and/or sheen, were not encountered during this investigation. Soil boring logs are provided in Appendix B.

Additionally, surficial soil samples (LSS-1 through LSS-11) were completed throughout the landscaped and unpaved portions of the Site. Surficial soil sample locations were advanced using a shovel and hand auger. Surficial soil sample LSS-6 and LSS-9 through LSS-11 were collected from the 2-inch interval directly beneath vegetative cover and surficial soil sample locations LSS-1 through LSS-5 and LSS-7 and LSS-8 were collected from the 2-inch interval directly beneath the coarse aggregate (i.e. stone or gravel) cover. No PID readings above background were measured in any of the surficial soil samples collected.

6.2.2 Soil Sampling Methodology

A total of 43 discrete soil samples (including two blind duplicate samples) and a total of 12 surficial soil samples (including one blind duplicate) were collected for laboratory analysis.

As discussed above, in order to delineate the metals and PAHs impacts detected in 20 composite waste characterization samples, ten soil borings (LSB-19 through LSB-28) were advanced throughout the Site. The delineation sampling program and rationale is presented in Table 1B.

In order to further characterize the former printer operations throughout the Site, six discrete soil samples were collected from three borings (LSB-21, LSB-22, and LSB-23) from the interval directly below ground surface (0 to 2 feet bgs) and 20 to 22 feet bgs. In order to further characterize Site-wide conditions, four discrete soil samples were collected from two borings (LSB-24 and LSB-27) from the interval directly below ground surface (0 to 2 feet bgs) and 20 to 22 feet bgs and eleven surface soil samples (LSS-1 through LSS-11) were collected throughout the landscaped and unpaved portions of the Site. Soil samples for the characterization of the former printer operations and Site-wide conditions were submitted for laboratory analysis of VOCs, SVOCs, PCBs, pesticides, herbicides, TAL Metals, hexavalent chromium, trivalent chromium, total cyanide, per- and polyfluoroalkyl substances (PFAS), and 1,4-dioxane.

Samples submitted for VOC analysis were collected from a discrete six-inch interval directly from the acetate liner via laboratory-supplied Terra Core soil samplers. PFAS samples were also collected directly from the acetate liner using dedicated nitrile gloves to limit the potential for cross contamination and placed in appropriate laboratory-supplied containers. The remaining two-foot sample interval volume was homogenized and placed in appropriate laboratory-supplied containers for all additional analyses. The sample containers were labeled, placed in a laboratory-supplied cooler and packed on ice (to maintain a temperature of 4±2°C). The sample coolers were picked up and delivered via courier under standard chain-of-custody protocol to by Alpha Analytical, Inc (Alpha), a NYSDOH ELAP-certified analytical laboratory (ELAP ID No. 11148 [Westboro Laboratory] and No. 11627 [Mansfield Laboratory]). In addition, QA/QC samples including three duplicate samples, three field blanks, and three trip blanks were collected. A sample summary is provided as Table 1.

6.3 Groundwater Investigation

A Langan field engineer documented the installation of permanent groundwater monitoring wells LMW-7 through LMW-12 by AARCO. Monitoring well locations are provided on Figure 5, and construction logs are included in Appendix B.

6.3.1 Monitoring Well Installation and Development Methodology

Monitoring wells LMW-7 through LMW-12 were installed via direct-push drilling to approximately 35 feet bgs. All wells were constructed with 10 feet of 2-inch diameter 0.020-inch slot schedule 40 PVC well screen and the remainder of the

well was constructed of 2-inch diameter schedule 40 PVC riser. The well annulus around the screen of both wells was backfilled with No. 00 sand to a depth corresponding to approximately 2 feet above the screened interval. A 2-foot thick hydrated bentonite seal was installed above the sand pack. The remaining annulus was backfilled with soil cuttings developed during well drilling activities and placed at depths generally consistent with which the cuttings were retrieved. The monitoring wells were finished with flush-mount metal protective casings and concrete.

Following well construction completion, each well on Site was developed using surge pumping techniques across the well screen to agitate and remove fine particles. The whale pump was surged across the submerged well screen in 2- to 3-foot increments for approximately 2 minutes per increment. After surging, the well was purged until the water became clear. Purged groundwater was monitored using a water quality meter until turbidity was measured to below 50 nephelometric turbidity units (NTUs). LMW-9 was the only monitoring well that stabilized (within a 10% range) at a turbidity greater than 50 NTUs. As such, LMW-9 continued to be purged and the parameters pH, conductivity, and temperature were measured over five-minute intervals. The well was considered to be developed when turbidity, pH, conductivity, and temperature were each stabilized within a 10% range. Purged groundwater from development activities was discharged to the vegetated Site surface as the historical data only identified limited metals concentrations above groundwater standards and no impacts (odor, sheen, and/or product) were observed in the wells.

All groundwater monitoring wells were surveyed by a licensed surveyor. All groundwater monitoring wells were gauged with an oil/water interface probe. Groundwater was encountered at depths ranging from approximately 22.65 to 27.54 feet bgs corresponding with approximately el +5.35 and el +7.94. Groundwater flow direction was determined to be towards the south. A potentiometric surface map is provided as Figure 3.

Groundwater monitoring well locations are shown on Figure 5. Well construction details are provided in Appendix B.

6.3.2 Groundwater Sampling Methodology

Groundwater samples were collected from LMW-7 through LMW-10 and LMW-12 nine days following the well development activities. Samples were collected

in accordance with the procedures in the USEPA's low-flow groundwater sampling procedure ("Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW 001, 19 January 2010) to allow for collection of a representative sample. Monitoring wells were purged and physical/chemical parameters (e.g., temperature, dissolved oxygen, oxygen reduction potential, and turbidity) were allowed to stabilize to ranges specified in the USEPA guidance before sampling, or until one hour of parameter readings were obtained if stabilization did not occur. Water level readings were not obtained during purging activities to prevent PFAS contamination. Monitoring wells were purged and sampled using a peristaltic pump with dedicated high density polyethylene tubing and VOC samples were collected using a dedicated Teflon bailer. PFAS samples were collected using dedicated nitrile gloves to limit cross contamination. No notable field observations of impacts were identified during purging and sample collection. Purge water was discharged to the vegetated Site surface. Low flow groundwater sampling parameter sheets are provided in Appendix C.

Six groundwater samples (including one blind duplicate sample) were collected from LMW-7 through LMW-10 and LMW-12 into laboratory-supplied glassware, packed with ice to maintain a temperature of ±4°C, and transported via courier service to Alpha under chain-of-custody protocol. QA/QC samples including one duplicate sample, one field blank, and one trip blank were collected. Groundwater samples were analyzed for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, total and dissolved TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane.

6.4 Soil Vapor Investigation

Nine exterior soil vapor sampling points (LSV-10 through LSV-18) were installed to approximately 20 feet bgs, the interval immediately beneath the remedial excavation depth . One duplicate soil vapor and two ambient air samples were collected for QA/QC purposes. Sampling was conducted in general accordance with the NYSDOH October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in New York.

6.4.1 Soil Vapor Implant Installation and Sampling Procedures

Temporary soil vapor sampling points LSV-10 through LSV-18 were installed by AARCO and sampled by Langan. Soil vapor points were installed to 20 feet bgs. Each of the soil vapor points was installed via direct push drilling. Temporary soil vapor sampling points were installed using Teflon-lined polyethylene tubing

connected to a dedicated expendable six-inch stainless steel screen. No. 1 sand was used to backfill up to approximately one-foot above the screened interval followed by a hydrated granular bentonite clay seal to the ground surface.

Prior to sampling, each soil vapor sampling point was tightness tested using the helium tracer gas method and purged at a flow rate of <200-ml per minute. No evidence of helium breakthrough (i.e., helium concentrations above 5%) was observed in any of the sample locations before sample collection. PID readings for VOCs collected from the purged soil vapor were measured at concentrations ranging from 219 ppb (LSV-18) to 4,969 ppb (LSV-15) during field screening of each location. Soil vapor sampling locations are shown on Figure 5 and soil vapor sampling field logs are provided in Appendix D.

Soil vapor samples were collected in laboratory-cleaned and certified evacuated 6-L stainless steel summa canisters with regulators supplied by Alpha and were laboratory analyzed for VOCs via USEPA TO-15 Method. The regulators were set to collect each sample over a 2-hour sampling period (a flow-rate of <200-ml per minute) as per USEPA/ITRC soil vapor sampling guidance. Each soil vapor sample was numbered and recorded in a field log book. Samples were transferred to the laboratory immediately after field sampling was completed, and stored at a maximum room temperature of 30º Celsius. Chain-of-custody forms were utilized to document custody for the acquisition, possession, and analysis.

6.4.2 Ambient Air Sampling Procedures

Concurrently with soil vapor sampling, two ambient air samples were collected to evaluate external influences on soil vapor quality for quality assurance purposes.

The ambient air samples were collected in laboratory-cleaned and certified evacuated 6-L stainless steel summa canisters with regulators supplied by Alpha and were laboratory analyzed for VOCs via USEPA TO-15 Method. The regulators were set to collect the sample over an 8-hour sampling period (a flow-rate of <12.5-ml per minute). The samples were numbered and recorded in a field log book and subsequently transferred to the laboratory immediately after field sampling was completed, and stored at a maximum room temperature of 30º Celsius. Chain-of-custody forms were utilized to document custody for the acquisition, possession, and analysis.

6.5 Quality Assurance Samples and Data Validation

All soil, groundwater, and soil vapor sampling devices were properly decontaminated according to NYSDEC and ASTM (ASTM D-5088-90) guidelines prior to each sampling location. For soil sampling this included the use of a dedicated acetate liner within a stainless steel macrocore sampling device. Soil samples were then placed in glassware supplied by the laboratory. For groundwater, dedicated high density polyethylene tubing was used. Groundwater samples were collected directly into glassware supplied by the laboratory. For soil vapor, dedicated expendable six-inch stainless steel screens and tubing were used.

Each sample was numbered and recorded in a field log book. Soil and groundwater samples were transferred to the laboratory immediately after field sampling was completed, and were stored at a maximum of 4° Celsius. Soil vapor samples were transferred to the laboratory immediately after field sampling was completed, and were stored at a maximum room temperature of 30º Celsius. Chain-of-custody forms were utilized to document custody for the acquisition, possession and analysis.

Quality assurance (trip blanks) and quality control samples (field blank samples, duplicate samples, matrix spike/matrix spike duplicate [MS/MSD] samples, and ambient air samples) were incorporated into the sampling events and consisted of four field blanks (three for soil and one for groundwater), five duplicate samples (three for soil, one for groundwater, and one for soil vapor), four trip blanks (three for soil and one for groundwater), four MS/MSD (three for soil and one for groundwater), and two ambient air samples for soil vapor.

One surficial soil duplicate sample was collected from the LSS-6 location for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane analysis; the analytical results were consistent with those reported for the LSS-6 sample with the exception of benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and tetrachloroethene which were compared to precision criteria and subsequently qualified.

One soil duplicate sample was collected from the LSB-21E location for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane analysis; the analytical results were consistent with those reported for the LSB-21E sample. One soil duplicate sample was collected from the LSB-23D location for TCL VOCs, TCL SVOCs, pesticides, PCBs,

herbicides, TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane analysis; the analytical results were consistent with those reported for the LSB-23D sample with the exception of 4,4-DDE, acenapthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dieldrin, fluoranthene, indeno(1,2,3-cd)pyrene, lead, phenanthrene, and pyrene which were compared to precision criteria and subsequently qualified. Four soil sampling field blanks were also collected and analyzed for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, total metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane. The VOC acrylonitrile; the SVOC di-n-butylphthalate; the metals aluminum, calcium, copper, iron, nickel, and sodium were detected. Four trip blanks were collected and analyzed for VOCs, and acetone was detected in one TB sample (TB-1). Data usability is discussed in Section 6.6.4.

A groundwater duplicate sample was collected from the LMW-9 location for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, total and dissolved TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane analysis; the analytical results were consistent with those reported for the LMW-9 sample. A field blank was also collected and analyzed for TCL VOCs, TCL SVOCs, pesticides, PCBs, herbicides, total and dissolved TAL metals, cyanide, hexavalent chromium, trivalent chromium, PFAS, and 1,4-dioxane. The metals barium, iron, dissolved iron, dissolved potassium, sodium, and dissolved sodium; and the PFAS compounds perfluorohexanoic acid and perfluorooctanesulfonic acid were detected in the field blank. One trip blank was collected and analyzed for VOCs, and no detections were reported in the samples. Data usability is discussed in Section 6.6.4.

A soil vapor duplicate sample was collected from sampling point LSV-15 for VOC analysis and met the precision criteria. Two ambient air samples were collected for VOCs. Compounds detected in the samples include 2,2,4-trimethylpentane, acetone, benzene, chloromethane, dichlorodifluoromethane, ethanol, ethylbenzene, isopropanol, m,p-xylene, n-hexane, o-xylene, toluene, trichlorofluoromethane, and total xylenes. With the exception of chloromethane, these compounds were also detected in corresponding soil vapor samples collected. Data usability is discussed in Section 6.6.4.

Analytical data was submitted to a Langan validator for review in accordance with USEPA and NYSDEC validation protocols. A DUSR was prepared for each delivery group following data validation. The DUSR presents the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-

of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. For each of the organic analytical methods, the following was assessed:

- Holding times
- Instrument tuning
- Instrument calibrations
- Blank results
- System monitoring compounds or surrogate recovery compounds (as applicable)
- Internal standard recovery results
- MS/MSD results
- Target compound identification
- Chromatogram quality
- Compound quantization and reported detection limits
- System performance
- Results verification

DUSRs are provided in Appendix F. Based on the results of data validation, the following qualifiers may be assigned to the data in accordance with the USEPA guidelines and best professional judgment:

- **R** – The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
- **J** – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- **UJ** – The analyte was not detected at a level greater than or equal to the reporting limit (RL); however, the reported RL is approximate and may be inaccurate or imprecise.
- **U** – The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the RL or the sample concentration for results impacted by blank contamination.
- **NJ** – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

After data validation was complete, validated data was used to prepare the tables and figures included in this report.

6.6 Laboratory Analytical Results

Summaries of the laboratory analytical results for surficial soil, soil, groundwater, and soil vapor are provided in Tables 2A, 2B, 2C, 2D, 3A, 3B, and 4 and are shown on Figures 9A, 9B, 10, and 11. Analytical results are discussed in detail below. The complete laboratory analytical packages are provided in Appendix E.

6.6.1 Surficial Soil Analytical Results

All surficial soil analytical results were compared to the NYSDEC SCOs (including the Unrestricted Use SCOs, Restricted Residential RUSCOs, and Protection of Groundwater SCOs) and are summarized in Tables 2A and 2B and on Figure 9A. Duplicate surficial soil samples results are not included in the discussion as these samples are collected for quality assurance/quality control verification of the laboratory results only and are discussed in Section 6.5.

<u>VOCs</u>

Analytical results revealed exceedances of the NYSDEC Unrestricted Use and Protection of Groundwater SCO for acetone (0.058 (0.051 milligrams per kilogram [mg/kg] – 0.24 mg/kg) in seven of the eleven sample locations. No exceedances of the Restricted Residential RUSCOs and/or Protection of Groundwater SCOs were identified for any other VOCs.

<u>SVOCs</u>

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs for polycyclic aromatic hydrocarbons (PAHs), a subset of SVOCs typically indicative of the presence of historic fill.

Exceedances of the NYSDEC Unrestricted Use SCOs included benzo(k)fluoranthene (2.1 mg/kg) and chrysene (1.2 mg/kg – 1.3 mg/kg). Exceedances of both the Unrestricted Use SCOs and Restricted Residential RUSCOs include benzo(a)anthracene (1.2 mg/kg – 5.8 mg/kg), benzo(a)pyrene (1.2 mg/kg – 5.7 mg/kg), benzo(b)fluoranthene (1.1 mg/kg – 7.3 mg/kg), chrysene (6.1 mg/kg), dibenzo(a,h)anthracene (0.94 mg/kg), and indeno(1,2,3-

c,d)pyrene (0.6 mg/kg – 3.9 mg/kg). Protection of Groundwater SCO exceedances include benzo(a)anthracene (1.2 mg/kg – 5.8 mg/kg), benzo(b)fluoranthene (7.3 mg/kg), benzo(k)fluoranthene (2.1 mg/kg), and chrysene (1.2 mg/kg – 6.1 mg/kg). The sample collected from LSS-10, located in the northern portion of the Site, from 0 to 2 inches bgs exhibited the highest concentrations of PAHs.

Pesticides

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs for pesticides including the compounds 4,4'-DDD (0.00425 mg/kg – 0.00577 mg/kg), 4,4'-DDE (0.00626 mg/kg – 0.0901 mg/kg), 4,4'-DDT (0.00552 mg/kg – 0.0831 mg/kg), and dieldrin (0.00543 – 0.0144 mg/kg). The sample collected from LSS-5, located in the southwestern portion of the Site, from 0 to 2 inches bgs exhibited the highest concentrations of pesticides. No exceedances of the NYSDEC Restricted Residential RUSCOs or Protection of Groundwater SCOs were identified for pesticides.

Herbicides

Analytical results revealed no exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, or Protection of Groundwater SCOs.

PCBs

Analytical results revealed no exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, or Protection of Groundwater SCOs.

Inorganics

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs for metals. Unrestricted Use SCO exceedances include lead (79.6 mg/kg – 289 mg/kg), mercury (0.182 mg/kg – 0.511 mg/kg), and zinc (113 mg/kg – 370 mg/kg). Restricted Residential RUSCO exceedances include barium (406 mg/kg) and lead (657 mg/kg). Protection of Groundwater SCO exceedances include lead (657 mg/kg). The sample collected from LSS-10, located in the northern portion of the Site, from 0 to 2 inches bgs exhibited the highest concentrations of metals.

Emerging Contaminants (PFAS: 21-Compound List)

Twelve surficial soil samples (including one duplicate) were sampled for emerging contaminants PFAS per NYSDEC's initiative to understand the presence of these constituents in the environment across New York State. There are currently no regulatory soil standards for PFAS compounds in New York State. Analytical results are shown in Table 2B and on Figure 9A.

PFAS compounds were detected in all surficial soil samples collected. Compounds detected in soil samples ranged from 0.041 micrograms per kilogram (µg/kg) of perfluorobutanesulfonic acid in LSS-3 to 5.27 µg/kg of perfluorooctanesulfonic acid in LSS-5. Associated primary sample result were qualified appropriately based on concentrations of the aforementioned analytes. Total PFAS concentrations ranged from 0.379 µg/kg in LSS-8 to 10.646 µg/kg in LSS-5.

Conclusions

Impacts indicative of contaminated historic fill are present on Site to depths of 22 feet bgs in some parts of the Site. Exceedances of the analytes associated with contaminated historic fill, including PAHs, pesticides, and metals, were detected within the surficial soil layer. Total PFAS concentrations ranged from 0.379 µg/kg in LSS-8 to 10.646 µg/kg in LSS-5.

6.6.2 Subsurface Soil Analytical Results

All soil analytical results were compared to the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and Protection of Groundwater SCOs and are summarized in Tables 2C and 2D and on Figure 9B. Duplicate soil samples results are not included in the discussion as these samples are collected for quality assurance/quality control verification of the laboratory results only and are discussed in Section 6.5.

VOCs

Analytical results revealed exceedances of the NYSDEC Unrestricted Use and Protection of Groundwater SCOs for acetone (0.051 mg/kg – 0.26 mg/kg). No exceedances of the Restricted Residential RUSCOs were identified for VOCs.

SVOCs

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and Protection of Groundwater SCOs for PAHs.

Compounds detected in exceedances of the Unrestricted Use SCOs include benzo(k)fluoranthene (1 mg/k – 2.8 mg/kg) and chrysene (1.8 mg/kg – 3.6 mg/kg). Compounds exceeding both the Unrestricted Use SCO and Restricted Residential RUSCO include benzo(a)anthracene (1.1 mg/kg – 13 mg/kg), benzo(a)pyrene (1.4 mg/kg – 14 mg/kg), benzo(b)fluoranthene (1.2 mg/kg – 20 mg/kg), benzo(k)fluoranthene (4.4 mg/kg – 5.4 mg/kg), chrysene (4.5 mg/kg – 12 mg/kg), dibenzo(a,h,)anthracene (0.37 mg/kg – 2 mg/kg), and indeno(1,2,3-c,d)pyrene (0.52 mg/kg – 11 mg/kg). Protection of Groundwater SCO exceedances include benzo(a)anthracene (1.1 mg/kg – 13 mg/kg), benzo(b)fluoranthene (2.6 mg/kg – 20 mg/kg), benzo(k)fluoranthene (1.8 mg/kg – 5.4 mg/kg), chrysene (1.8 mg/kg – 12 mg/kg), and indeno(1,2,3-c,d)pyrene (11 mg/kg). The sample collected from LSB-21, located in the northern portion of the Site, from 5 to 7 feet bgs exhibited the highest concentrations of PAHs.

Pesticides

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs for pesticides. The compounds 4,4'-DDD (0.00335 mg/kg – 0.0268 mg/kg), 4,4'-DDE (0.00506 mg/kg – 0.0292 mg/kg), 4,4'-DDT (0.0102 mg/kg – 0.199 mg/kg), and dieldrin (0.00581 – 0.00773 mg/kg) were identified in exceedances on the Unrestricted Use SCOs. The sample collected from LSB-21, located in the northern portion of the Site, from 20 to 22 feet bgs exhibited the highest concentrations of pesticides. No exceedances of the NYSDEC Restricted Residential RUSCOs or Protection of Groundwater SCOs were identified for pesticides.

Herbicides

Analytical results revealed no exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs.

PCBs

Analytical results revealed no exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs.

Inorganics

Analytical results revealed exceedances of the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs for metals. Unrestricted Use SCO exceedances include trivalent chromium (31 mg/kg –

40 mg/kg), cadmium (3.32 mg/kg), copper (55.6 mg/kg – 81.3 mg/kg), lead (73.7 mg/kg – 303 mg/kg), mercury (0.202 mg/kg – 0.685 mg/kg), nickel (32.9 mg/kg – 72.3 mg/kg), silver (9.54 mg/kg), and zinc (115 mg/kg –3,190 mg/kg). Exceedances of the Unrestricted Use SCOs and Restricted Residential RUSCO include arsenic (56.4 mg/kg), barium (426 mg/kg – 1,280 mg/kg), cadmium (12.2 mg/kg), copper (568 mg/kg), lead (461 mg/kg – 1,700 mg/kg), and mercury (0.923 mg/kg – 3.52 mg/kg. Protection of Groundwater SCO exceedances include arsenic (56.4 mg/kg), barium (1,280 mg/kg), cadmium (12.2 mg/kg), lead (461 mg/kg – 1,700 mg/kg), mercury (0.806 mg/kg – 3.52 mg/kg), silver (9.54 mg/kg), and zinc (2,590 mg/kg – 3,190 mg/kg). The sample collected from LSB-19, located in the northwestern portion of the Site, from 10 to 12 feet bgs exhibited the highest concentrations of metals.

Emerging Contaminants (PFAS: 21-Compound List)

Twelve soil samples (including two duplicate samples) were sampled PFAS pursuant to NYSDEC's initiative to understand the presence of these constituents in the environment across New York State. There are currently no regulatory soil standards for PFAS compounds in New York State. Analytical results are shown in Table 2B and on Figure 9B.

PFAS compounds were detected in all soil samples collected except the sample collected from LSB-23 from 0 to 2 feet bgs. Compounds detected in soil samples ranged from 0.048 µg/kg of perfluorobutanoic acid in LSB-22 from 20 to 22 feet bgs to 1.42 µg/kg of perfluorooctanesulfonic acid in LSB-24 from 0 to 2 feet bgs. Total PFAS concentrations ranged from 0.362 µg/kg in LSB-23 from 20 to 22 feet bgs to 3.458 µg/kg in LSB-24 from 0 to 2 feet bgs.

Conclusions

Impacts indicative of contaminated historic fill are present on Site. Exceedances of the analytes associated with contaminated historic fill, including PAHs, pesticides, and metals, were detected within the contaminated historic fill layer.

Total PFAS concentrations ranged from 0.362 µg/kg in LSB-23 from 20 to 22 feet bgs to 3.458 µg/kg in LSB-24 from 0 to 2 feet bgs. The sources of PFAS contamination may be related to the two former laundry services on-Site, impacts caused to the Site from firefighting runoff from building materials when a fire occurred at the adjacent synagogue site, or an unidentified off-site source.

6.6.3 Groundwater Analytical Results

All groundwater analytical results were compared to the NYSDEC Ambient Water Quality Standards and Guidance Value (SGVs) and are summarized in Tables 3A and 3B and on Figure 10. Duplicate groundwater samples results are not included in the discussion as these results are discussed in detail in Section 6.5.

VOCs

Analytical results revealed exceedances of the NYSDEC SGVs for the VOC acetone (7.5 µg/L) in one groundwater sample (LMW-8) collected during the investigation.

SVOCs

Analytical results revealed exceedances of the NYSDEC SGVs for SVOCs in one groundwater sample (LMW-10) collected during the investigation. Exceedances include benzo(a)anthracene (0.15 µg/L), benzo(a)pyrene (0.16 µg/L), benzo(b)fluoranthene (0.19 µg/L), benzo(k)fluoranthene (0.06 J µg/L), chrysene (0.17 µg/L), and indeno(1,2,3-cd)pyrene (0.11 µg/L). Although stabilized, turbidity readings remained elevated at the time the groundwater sample was collected in in LMW-10. As such, the detections of SVOCs in groundwater are attributed to elevated turbidity.

Pesticides

Analytical results revealed no exceedances of the NYSDEC SGVs.

Herbicides

Analytical results revealed no exceedances of the NYSDEC SGVs.

PCBs

Analytical results revealed no exceedances of the NYSDEC SGVs.

Inorganics

Analytical results revealed exceedances of the NYSDEC SGVs for metals in all groundwater samples collected during the investigation. Exceedances include total iron (324 µg/L – 51,200 µg/L), total lead (266.6 µg/L), magnesium (87,900 µg/L – 156,000 µg/L), dissolved magnesium (72,400 µg/L – 116,000 µg/L), total manganese (371.8 µg/L – 7,272 µg/L), dissolved manganese (371.4 µg/L – 1,025 µg/L), total nickel (108 µg/L), total selenium (11.5 µg/L – 16.4 µg/L), dissolved selenium (17.3 µg/L), total sodium (40,100 µg/L – 312,000 µg/L), and dissolved sodium (38,200 µg/L – 235,000 µg/L). With the exception of lead at the LSB-

24/LMW-10 location, metals detected above the SGVs in groundwater were not detected at concentrations exceeding the Protection of Groundwater SCOs at soil boring locations where monitoring wells were installed. In addition, although stabilized, turbidity readings remained elevated at the time the groundwater sample was collected in in LMW-10. As such, the detections of metals in groundwater are attributed to naturally occurring background concentrations and elevated turbidity.

Emerging Contaminants (1,4-dioxane and PFAS: 21-Compound List)

All groundwater samples collected were sampled for emerging contaminants PFAS and 1,4-dioxane per NYSDEC's initiative to understand the presence of these constituents in the environment across New York State. There are currently no regulatory groundwater standards for PFAS compounds or 1,4-dioxane in New York State, even though Maximum Contaminant Levels (MCLs) were just promulgated for drinking water for perfluorooctanesulfonic acid and perfluorooctanoic acid. PFAS results were compared to screening values provided in the NYSDEC's Guidelines for Sampling and Analysis of PFAS (January 2020). Analytical results are shown in Table 3B and on Figure 10.

The compound 1,4-dioxane was not detected in groundwater samples. PFAS compounds were detected in all groundwater samples collected. Compounds detected in groundwater samples ranged from 0.309 nanograms per liter (ng/L) of perfluorononanoic acid in LMW-8 to 463 ng/L of perfluorooctanoic acid in LMW-9.

Perfluorooctanesulfonic acid was detected above the NYSDEC January 2020 guidance screening level developed by NYSDEC of 10 ng/L in groundwater samples collected from LMW-7 (15.7 ng/L) and LMW-12 (18 ng/L) and perfluorooctanoic acid was detected above the guidance value of 10 ng/L in all groundwater samples collected ranging from 34.6 ng/L in LMW-7 to 463 ng/L in LMW-9. Additionally, the following compounds were detected above the January 2020 guidance level of 100 ng/L in select wells: perfluorobutanesulfonic acid in LMW-10 (178 ng/L), perfluorohexanoic acid in LMW-12 (170 ng/L) and perfluoropentanoic acid in LMW-12 (145 ng/l). Total PFAS concentrations ranged from 129.67 ng/L in LMW-7 to 737.03 ng/L in LMW-12. Total PFAS concentrations were detected in exceedance of the January 2020 guidance level of 500 ng/L in samples collected from LMW-9 (574.90 ng/L) and LMW-12 (737.03 ng/L).

Conclusions

Analytical results revealed no exceedances of the NYSDEC SGVs for pesticides, herbicides, and PCBs. SVOCs and metals were detected in exceedance of NYSDEC SGVs, although these exceedances are likely attributable to naturally occurring background concentrations and elevated turbidity during sample collection.

According to the NYSDEC Guidelines Sampling and Analysis of PFAs dated January 2020, further assessment of PFAs should be completed if perfluorooctanesulfonic acid (PFOS) or perfluorooctanoic acid (PFOA) is detected above 10 ng/L, if individual PFAs compounds other than PFOA or PFAS are detected above 100 ng/L, or if the total concentration of PFAs compounds are detected above 500 ng/L. Exceedances of these guidance thresholds have been identified. The sources of PFAS contamination may be related to the two former laundry services on-Site, impacts caused to the Site from firefighting runoff from building materials when a fire occurred at the adjacent synagogue site, or an unidentified off-site source.

Laboratory reporting limits (RLs) were reported above SGVs for the VOCs 1,1,2-trichloroethane, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane, cis-1,3-dichloropropene, hexachlorobutadiene, total 1,3-dichloropropene, and trans-1,3-dichloropropene; the SVOCs 1,2,4,5-tetrachlorobenzene, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-chloroethyl)ether, chrysene, hexachlorobenzene, hexachlorocyclopentadiene, indeno(1,2,3-cd)pyrene, nitrobenzene, and phenol; the pesticides aldrin, alpha-BHC, chlordane, dieldrin, endrin, and toxaphene; the herbicide silvex; and the metal, total and dissolved antimony. The RLs for the above referenced compounds were consistent for all of the groundwater samples that were collected, and are the result of the analytical method used by the laboratory and its detection limits for those compounds. [As discussed in Section 6.6.5, all laboratory analytical results were validated and determined to be usable. Data usability summary reports are provided in Appendix F.

6.6.4 Soil Vapor Analytical Results

Exterior soil vapor analytical results were compared to NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion Matrices A through C dated October 2006 and revised in May 2017. These results are summarized in Table 4 and are shown on Figure 11.

The soil vapor results identified elevated concentrations of petroleum-related VOCs including BTEX at cumulative concentrations that ranged from 21.32 microgram per cubic meter (µg/m^3) at LSV-18 to 110.85 µg/m^3 at LSV-1). BTEX compounds were detected in all soil vapor samples collected. Additional petroleum-related VOCs including 1,2,4-trimethylbenzene (4.45 µg/m^3 – 24.6 µg/m^3) and 1,3,5-trimethylbenzene (1.35 µg/m^3 – 6.34 µg/m^3) were also detected. The highest concentrations of petroleum related compounds were identified in LSV-12 located in the northern portion of the Site.

The VOCs cis-1,2-dichloroethene, 1,1-dichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, methylene chloride, and vinyl chloride were not detected in any of the soil vapor samples. According to the NYSDOH Soil Vapor Intrusion Matrix A, TCE concentrations (2.21 µg/m^3 – 17.6 µg/m^3) in soil vapor were identified above the monitoring and/or mitigation threshold of 6 µg/m^3 in two soil vapor samples (LSV-11 and LSV-13). According to the NYSDOH Soil Vapor Intrusion Matrix B, PCE concentrations (6.22 µg/m^3 – 164 µg/m^3) in soil vapor were identified above the monitoring and/or mitigation threshold of 100 µg/m^3 in two soil vapor samples (LSV-13 and LSV-14).

<u>Conclusions</u>

The 2020 RI soil vapor evaluation identified impacts that would require monitoring or mitigation per the NYSDOH guidance values in soil vapor samples LSV-11, LSV-13, and LSV-14 in the northern portion of the site. BTEX were also identified in these samples. As these three sample locations are located in close proximity to historical uses of concern including printers and laundry facilities, the presence of elevated concentrations of TCE and PCE may be attributed to releases associated with historical Site operations. However, as these compounds were not detected at concentrations exceeding NYSDEC threshold values in soil or groundwater at the site, the presence of elevated concentrations of these compounds in soil vapor, particularly in close proximity to the boundaries of the Site, is attributed to offsite sources.

6.6.5 Data Usability

The DUSRs were prepared in accordance with DER-10 and reviewed by Langan's in-house validator before issuance. The DUSRs presented the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of deficiencies for each analytical method. DUSRs for the RI are provided in Appendix F.

All data are considered usable, as qualified, with the exception of the rejected results which includes the metal silver in groundwater sample LMW-12. Some data qualifiers were appended to the reported results, which have been included in the respective data summary tables (Tables 2A through 4). Copies of the DUSRs are included in Appendix F.

6.7 Evaluation of Areas of Concern

This section discusses the results of the RI with respect to the AOCs described in detail in Section 5.0.

6.7.1 AOC 1: Historic Fill

Historical soil sample analytical results exceeding the Unrestricted Use SCOs and Restricted Residential RUSCOs for SVOCs, pesticides, and metals were detected throughout the Site in discrete shallow soil samples (0 to 2 feet bgs) and in composite waste characterization soil samples (0 to 5 feet, 5 to 10 feet, 10 to 15 feet, and 15 to 20 feet). The historic fill layer was visually observed to range from approximately 11.5 feet thick in the central portion (LSB-10) to approximately 30 feet thick in the northeast portion (LSB-4), where the base of the fill was not encountered prior to the boring termination depth of 30 feet below grade, and predominantly consisted of light brown to brown and red brown sand and varying amounts of brick, gravel, concrete, wood, and silt.

AOC 1 - Soil

Contaminated historic fill characteristics and contaminants observed during this investigation are consistent with results of previous investigations. Exceedances of analytes associated with historic fill, including PAHs, pesticides, and metals, above the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs were detected within the historic fill layer.

As discussed in detail in Section 6.2.2, in order to delineate the impacts detected in the composite waste characterization samples, ten soil borings were advanced throughout the site. A summary of the soil analytical results for AOC 1 is provided below.

0 to 5 feet

Discrete soil samples were collected from within the 0- to 5-foot interval from soil borings LSB-19, LSB-20, LSB-21, LSB-22, LSB-24, LSB-25, LSB-26, and LSB-28.

- Acetone is the only VOC that was detected above the Unrestricted Use SCOs and/or Protection of Groundwater SCOs in LSB-21, LSB-23, LSB-24, and LSB-27.
- Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19, LSB-20, LSB-21, LSB-22, LSB-24, and LSB-28.
- Ten metals, including arsenic, barium, cadmium, trivalent chromium, copper, lead, mercury, nickel, silver, and zinc were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19, LSB-20, LSB-21, LSB-22, LSB-24, LSB-25, and LSB-28.

5 to 10 feet

Discrete soil samples were collected from within the 5- to 10-foot interval from soil borings LSB-19 through LSB-28.

- Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19, LSB-21, and LSB-28.

- Four metals, including barium, lead, mercury, and zinc were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19, LSB-21, LSB-22, LSB-23, and LSB-28.

10 to 15 feet

Discrete soil samples were collected from within the 10- to 15-foot interval from soil borings LSB-19 through LSB-24 and LSB-26 through LSB-28.

- Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19 and LSB-22.
- Six metals, including cadmium, copper, lead, mercury, nickel and zinc were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-19 through LSB-22.

15 to 20 feet

Discrete soil samples were collected from within the 15- to 20-foot interval from soil borings LSB-19, LSB-20, LSB-21, LSB-22, LSB-24, and LSB-28.

- No SVOCs or metals were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in any of the samples collected.

20 to 22 feet

Discrete soil samples were collected from within the historic fill layer from the 20- to 22-foot interval in soil borings LSB-21 and LSB-22.

- Acetone is the only VOC that was detected above the Unrestricted Use SCOs and/or Protection of Groundwater SCOs in samples collected from all five borings.
- Two SVOCs (benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from LSB-21.
- Four pesticides, including 4'4-DDD, 4,4'-DDE, 4,4-DDT, and dieldrin were detected above the Unrestricted Use SCOs in LSB-21.
- Two metals were detected above the Unrestricted Use SCOs including lead in LSB-21 and nickel in LSB-22.

AOC 1 - Groundwater

Soil borings LSB-21 through LSB-24 and LSB-27 were completed as permanent monitoring wells LMW-7 through LMW-10 and LMW-12, respectively. A summary of the groundwater analytical results for AOC 1 is summarized as follows:

- One VOC (chloroform) was detected above the SGV in LMW-8.
- Six SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in LMW-10.
- Seven total and four dissolved metals, including iron, lead, magnesium, manganese, nickel, selenium, and sodium were detected in all groundwater samples collected.
- Pesticides, PCBs and herbicides were not detected above the SGVs in any groundwater samples collected.

AOC 1 – Soil Vapor

Soil vapor points LSV-10 through LSV-18 were installed as part of the site-wide soil vapor assessment. The results for soil vapor points LSV-11 through LSV-14 are discussed in Section 6.7.2 with regard to AOC 2. A summary of the soil vapor analytical results for LSV-10 and LSV-15 through LSV-18 is summarized as follows:

- No NYSDOH Soil Vapor Intrusion Matrix compounds were detected above monitoring and/or mitigation thresholds in any of the soil vapor samples.

- Petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all five samples.

AOC 1 Conclusions

Concentrations of PAHs and metals in soil are attributed to the presence of historic fill material throughout the Site footprint. Detections of metals in groundwater are attributed to naturally occurring background concentrations and elevated turbidity during sample collection at LMW-10, as all groundwater parameters had stabilized within appropriate ranges although turbidity readings remained above 120 NTU.

Concentrations of NYSDOH Soil Vapor Intrusion Matrix compounds were not detected above monitoring and/or mitigation thresholds in any of the samples collected. Petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all five samples. The presence of petroleum-related VOCs may be attributed to releases associated with historical site operations; however, as these compounds were not detected at elevated concentrations in soil or groundwater at the site, the presence of these compounds in soil vapor is attributed to an offsite source.

6.7.2 AOC 2: Historical Site Use

Operations of concerns were historically located along the northern and eastern frontage of the Site including printing between 1905 and 1950, a coppersmith and tinsmith (1920), and laundry services (1922, 1947-1968). Potential releases of petroleum products, solvents, and/or other hazardous materials associated with these uses during the on-site operations may have adversely affected soil, groundwater and/or soil vapor.

AOC 2 - Soil

In order to further characterize the former printer operations throughout the Site, six discrete soil samples were collected from three borings (LSB-21, LSB-22, and LSB-23) from the interval directly below ground surface (0 to 2 feet bgs) and 20 to 22 feet bgs. All samples were collected from historic fill with the exception of the deep sample collected from LSB-23 which was collected from native sand. A summary of the soil analytical results for AOC 2 is summarized as follows:

- One VOC (acetone) was detected above the Unrestricted Use SCOs in shallow soil samples collected from LSB-21 and LSB-23 and in deep soil samples collected from all three boring locations. However, acetone is a common laboratory artifact and is likely not associated with historical site uses.
- Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in samples collected from the historic fill layer in both samples collected from LSB-21, the shallow sample collected from LSB-22, and the deep sample collected from LSB-23.
- Five metals, including trivalent chromium, lead, mercury, nickel, and zinc were detected above the Unrestricted Use SCOs in both samples collected LSB-21 and LSB-22 and from the shallow sample collected from LSB-23.
- Four pesticides, including 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin were detected above Unrestricted use SCOs in both samples collected from LSB-21, the shallow sample collected from LSB-22, and both samples collected from LSB-23.
- Total PCBs and herbicides were not detected above Unrestricted Use SCOs in any soil samples collected.

AOC 2 – Groundwater

Soil borings LSB-21 through LSB-23 were completed as permanent monitoring wells LMW-7 through LMW-9, respectively. A summary of the groundwater analytical results for AOC 2 is summarized as follows:

- One VOC (chloroform) was detected above the SGV in LMW-8.
- Four total and four dissolved metals, including magnesium, manganese, selenium, and sodium were detected in LMW-7 through LMW-9.
- SVOCs, pesticides, PCBs and herbicides were not detected above the SGVs in any groundwater samples collected.

AOC 2 – Soil Vapor

Soil vapor points LSV-11 through LSV-14 were installed in the vicinity of the historical site uses of concern along the northern frontage (LSV-11, LSV-12,

and LSV-14) and the eastern frontage (LSV-13). A summary of the soil vapor analytical results for AOC 2 is summarized as follows:

- NYSDOH Soil Vapor Intrusion Matrix compound TCE was identified above the monitoring and/or mitigation threshold of 6 µg/m^3 in LSV-11 and LSV-13.
- NYSDOH Soil Vapor Intrusion Matrix compound PCE was identified above the monitoring and/or mitigation threshold of 100 µg/m^3 in LSV-13 and LSV-14.
- NYSDOH Soil Vapor Intrusion Matrix compounds cis-1,2-dichloroethene, 1,1-dichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, methylene chloride, and vinyl chloride were not detected above monitoring and/or mitigation thresholds in any of the soil vapor samples.
- Petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all four samples. The highest concentrations of petroleum related compounds were identified in LSV-12 located in the northern portion of the Site.

AOC 2 Conclusions

Concentrations of VOCs, PAHs, pesticides, and metals in soil are attributed to the presence of historic fill material and not the historical Site uses. Detections of metals in groundwater are attributed to naturally occurring background concentrations.

Detections of TCE and PCE above the NYSDOH Soil Vapor Intrusion Matrices monitoring and/or mitigation thresholds were identified in three of the four soil vapor samples collected in close proximity to historical site uses of concern and petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all four samples. As these three sample locations are located in close proximity to historical uses of concern including printers and laundry facilities, the presence of elevated concentrations of TCE and PCE and petroleum-related VOCs may be attributed to releases associated with historical site operations. However, as these compounds were not detected at notable concentrations in soil or groundwater at the site, the presence of elevated concentrations of these

compounds in soil vapor, particularly in close proximity to the boundaries of the Site, may also be attributed to an offsite source.

6.7.3 Site-Wide Assessment

The results of this investigation were also used to perform a Site wide assessment of soil, groundwater, and soil vapor.

Site-Wide Assessment - Soil

In order to further characterize Site-wide conditions, four discrete soil samples were collected from two borings (LSB-24 and LSB-27) from the interval directly below ground surface (0 to 2 feet bgs) and 20 to 22 feet bgs and eleven surface soil samples (LSS-1 through LSS-11) were collected throughout the landscaped and unpaved portions of the site. Samples collected from 20 to 22 feet bgs from soil boring LSB-23 and from 13 to 15 feet bgs from soil boring LSB-25 are also discussed as part of the Site-wide assessment as they were collected from beneath the historic fill layer. A summary of the soil analytical results for the Site-wide assessment is summarized as follows:

- One VOC (acetone) was detected above the Unrestricted Use and Protection of Groundwater SCOs in both the shallow and deep soil samples collected from LSB-24 and LSB-27, from the sample collected from LSB-23, and in surface soil samples LSS-2, LSS-4, and LSS-7 through LSS-11. However, acetone is a common laboratory artifact and is likely not associated with Site impacts.
- Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in both the shallow and deep soil samples collected from LSB-24 and LSB-27, in the sample collected from LSB-23, and in surface soil samples LSS-3, LSS-5, LSS-6, LSS-8, LSS-9, and LSS-10.
- Three metals, including lead, mercury, and zinc were detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in the shallow samples collected from LSB-24 and LSB-27 and in surface soil samples LSS-1 through LSS-10.

Arsenic was also detected above the Unrestricted Use SCOs and Restricted Residential RUSCOs in LSS-8.

- Three pesticides, including 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected above Unrestricted Use SCOs in both the shallow and deep soil samples collected from LSB-24 and LSB-27, in the sample collected from LSB-23, and in surface soil samples LSS-1 through LSS-11. Dieldrin was also detected above the Unrestricted Use SCOs in LSS-3, LSS-4, LSS-10, and LSS-11.
- PFAS compounds were detected in all surficial soil samples collected and in all soil samples collected for which it was analyzed except the sample collected from LSB-23 from 0 to 2 feet bgs.
- Total PCBs and herbicides were not detected above Unrestricted Use SCOs in any soil samples collected.

Site-Wide Assessment - Groundwater

Soil borings LSB-24 and LSB-27 were completed as permanent monitoring wells LMW-10 and LMW-12, respectively. A summary of the groundwater analytical results for the Site-Wide Assessment is summarized as follows:

- SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) were detected above the SGVs in LMW-10.
- Four total and four dissolved metals, including magnesium, manganese, selenium, and sodium were detected in LMW-7 through LMW-9.
- Metals including total iron, total manganese, and total and dissolved sodium were detected above the SGVs in both samples. Dissolved manganese was also detected above the SGVs in LMW-12 and total lead, total and dissolved magnesium, nickel, and dissolved selenium were also detected above the SGVs in LMW-10.
- PFAS compounds were detected in all groundwater samples collected.
- VOCs, pesticides, total PCBs, and herbicides were not detected above the SGVs in either sample.

Site-Wide Assessment – Soil Vapor

Soil vapor points LSV-10 through LSV-18 were installed as part of the site-wide soil vapor assessment. The results for soil vapor points LSV-11 through LSV-14 are discussed in Section 6.7.2 with regard to AOC 2. A summary of the soil

vapor analytical results for LSV-10 and LSV-15 through LSV-18 is summarized as follows:

- No NYSDOH Soil Vapor Intrusion Matrix compounds were detected above monitoring and/or mitigation thresholds in LSV-10 and LSV-15 through LSV-18.
- Petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all five samples.

Site-Wide Assessment Conclusions

Concentrations of VOCs, PAHs, pesticides, and metals in soil are likely associated with the general quality of the historic fill material. Detections of metals in groundwater are attributed to naturally occurring background concentrations and elevated turbidity during sample collection at LMW-10, as all groundwater parameters had stabilized within appropriate ranges although turbidity readings remained above 120 NTU.

Concentrations of NYSDOH Soil Vapor Intrusion Matrix compounds were not detected above monitoring and/or mitigation thresholds in any of the samples collected outside of AOC 2. Petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were detected in all five samples. The presence of petroleum-related VOCs may be attributed to releases associated with historical site operations; however, as these compounds were not detected at notable concentrations in soil or groundwater at the site, the presence of elevated concentrations of these compounds in soil vapor may also be attributed to an offsite source.

7.0 QUALITATIVE HUMAN AND FISH/WILDLIFE EXPOSURE ASSESSMENT

Human health exposure risk was evaluated for both current and future Site and off-Site conditions, in accordance with the May 2010 NYSDEC Final DER-10 Technical Guidance for Site Investigation and Remediation. The assessment includes an evaluation of potential sources and migration pathways of Site contamination, potential receptors, exposure media, and receptor intake routes and exposure pathways.

In addition to the human health exposure assessment, NYSDEC DER-10 requires an on-Site and off-Site Fish and Wildlife Resources Impact Analysis (FWRIA) if certain criteria are met. Based on the requirements stipulated in Section 3.10 and Appendix 3C of DER-10, completion of an FWRIA was not required for the Site.

7.1 Current Conditions

The Site is located in the Lower East Side section of Manhattan, New York and is identified as Block 346 Lot 75. The Site is an approximately 23,960-square foot parcel and is bound to the north by Broome Street followed by an at-grade parking facility, to the east by Suffolk Street followed by a mixed-use property with a large asphalt-paved parking area, to the south by a five-story mixed-use building, and to the west by the 14-story Hong Ning Housing for the Elderly building and the former Beth Hamedrash Hagodol Synagogue, which was demolished in June 2020. The Site contains an old asphalt paved parking lot, a concrete patio area, and landscaped areas. The parking lot was recently significantly disturbed by the archeological test pit investigation, which was completed in accordance with the January 2020 IRM Work Plan; disturbed areas will be temporarily covered with a layer of gravel following completion of the IRM Work Plan activities until the remediation commences.

7.2 Proposed Conditions

The planned redevelopment of the Site consists of a multi-story mixed use building with a full cellar. The proposed building will contain mechanical and residential and retail storage spaces as well as a locker room and break room in the cellar and a ground-floor residential lobby, retail spaces, and community space. The second and third floors will be used for community facility spaces and the fourth through thirtieth floors will be occupied by residential apartments and amenities. Residential units will include 25% permanently affordable housing.

7.3 Summary of Environmental Conditions

SVOCs, metals, and pesticides were detected at concentrations above the NYSDEC Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in soil samples collected from the contaminated historic fill. The compound distribution and contaminant concentrations detected are typical of fill material in New York City. Metals were detected in groundwater at concentrations above the NYSDEC SGVs. Detections of metals are likely attributable to naturally occurring background concentrations and elevated turbidity during sample collection. Soil vapor sample analytical results revealed chlorinated VOCs at concentrations above the NYSDOH soil vapor intrusion guidance levels which would require monitoring or mitigation in addition to petroleum-related VOCs (BTEX) for which there are no NYSDOH guidance values.

7.4 Conceptual Site Model

A conceptual site model (CSM) was developed based on the findings of the RI and previous investigations to produce a simplified framework for understanding the distribution of impacted materials, potential migration pathways, and potentially complete exposure pathways.

7.4.1 Potential Sources of Contamination

Potential sources of contamination have been identified and include past uses of the Site and contaminated historic fill material. Historical on-Site use for printing are potential sources of VOCs and metals in soil, groundwater, and soil vapor. The Site-wide presence of historic fill has been established as a source of SVOCs, pesticides, and metals in soil. Detections of metals are likely attributable to naturally occurring background concentrations and detections of SVOCs and metals in LMW-10 specifically are attributed to elevated turbidity during sample collection. PFAS contamination in soil and groundwater may be related to the two former laundry services on-Site, impacts caused to the Site from firefighting runoff from building materials when a fire occurred at the adjacent synagogue site, or an unidentified off-site source.

7.4.2 Exposure Media

Impacted media include soil, groundwater, and soil vapor. Analytical data indicates that historic fill material contains SVOCs, pesticides, and metals at concentrations greater than the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or the Protection of Groundwater SCOs. PFAS is present in soil and groundwater at concentrations exceeding NYSDEC guidance thresholds. Soil vapor at the Site is impacted with petroleum-related VOCs (BTEX) and the chlorinated VOCs PCE and TCE; each of which were detected at concentrations above the NYSDOH soil vapor intrusion guidance levels which would require monitoring or mitigation.

7.4.3 Receptor Populations

The Site currently consists of an old asphalt paved parking surface, a concrete patio area, and landscaped areas. The asphalt pavement was recently disturbed by the archeological investigation, which was completed in accordance with the January 2020 IRM Work Plan; the disturbed areas will be temporarily covered with a layer of gravel following completion of the IRM Work Plan activities until the remediation commences. The Site is enclosed in fencing

and access is restricted to tenants and employees of the adjacent Hong Ning Housing for the Elderly building, personnel completing site investigations related to Site redevelopment, and other authorized personnel. Site access for tenants from the adjacent building is limited to the concrete patio where there is no potential exposure to any Site contaminants. The landscaped area around the concrete patio has also been fenced off to prevent access. Otherwise, site access is currently restricted to employees of the adjacent building who are temporarily allowed to park vehicles in the parking lot area.

During Site development and remediation, the only individuals accessing the Site will be limited to construction and remediation workers, authorized personnel, and design team members visiting the Site. Members of the public, including employees of the adjacent Hong Ning Housing for the Elderly building who currently park vehicles on the Site, will not be allowed access once the remediation commences.

Under future conditions, receptors will include the new building occupants, visitors to the building, and building management/maintenance employees.

7.5 Potential Exposure Pathways – On-Site

7.5.1 Current Conditions

Site access is currently limited to employees of the adjacent building to the west who park vehicles in the parking lot and tenants whose access is limited to only the concrete patio. Personnel completing Site investigations and other authorized personnel also have access. Tenant access is currently restricted to all portions of the Site other than the concrete patio via fencing and posted notification/signage. Therefore, in areas where human exposure to contaminated soil is possible, the potential exposure pathway for dermal absorption, inhalation and ingestion is mitigated by limiting Site access and activities to those noted above and via notification and signage until the remediation is performed.

Due to the depth of groundwater, and the fact that groundwater in New York City is not used as a potable water source, there is no complete exposure pathway to groundwater under current Site conditions. However, there is a potential exposure pathway through dermal absorption, inhalation, and ingestion for personnel conducting investigative groundwater sampling, but it is controlled through the implementation of the HASP during sampling.

Because the Site consists of an open air parking lot, a concrete patio, and landscaped areas and lacks enclosed spaces, there are minimal current on-Site exposure pathways for soil vapor intrusion. Soil vapor that may penetrate through the unpaved surface of the Site primarily migrates vertically through the subsurface and will dissipate and dilute with ambient air. Any remaining potential exposure pathways through dermal absorption and inhalation is controlled through the implementation of a HASP during ground-intrusive work.

7.5.2 Construction/Remediation Conditions

Implementation of a Construction Health and Safety Plan (CHASP) and a Community Air Monitoring Plan (CAMP) during construction and remedial activities will limit the potential for exposure of soil contaminants to construction and remediation workers via dermal absorption, ingestion, and inhalation of vapors and particulate matter. Members of the public, including employees of the adjacent Hong Ning Housing for the Elderly building who currently park vehicles on the Site, and tenants who currently access the patio area, will not be allowed access once the remediation commences. A construction fence will be installed around the perimeter of the entire Site to prevent access by unauthorized personnel.

7.5.3 Proposed Future Conditions

Currently, the contemplated project includes a 25% permanent affordable housing residential building with a commercial ground floor and community spaces on the second and third floors. The proposed building will have a full cellar, which will contain mechanical and residential and retail storage spaces as well as a locker room and break room. New development will incorporate vapor mitigation measures, which will prevent human exposure to soil vapor intrusion.

There is no pathway for ingesting groundwater contaminants, since the Site and surrounding areas obtain their drinking water supply from surface water reservoirs located upstate and not from groundwater.

Based on results of the previous investigations and this RI and the proposed remediation plan, which will include excavation to a depth of approximately 18 feet below street level across the entire Site footprint, it is anticipated that a Track 2 cleanup will be achieved; institutional controls and/or engineering controls will be included in the remedy to reach a Track 2 cleanup and to prevent exposure to any remaining residual contamination.

7.6 Potential Exposure Pathways – Off-Site

Soil vapor may migrate off-Site vertically through the subsurface and dissipate and dilute with ambient air in instances where the Site surface is compromised or during Site construction/remediation.

Based on the groundwater depth, dewatering is not anticipated during construction. As a result, there is no potential for human exposure to groundwater on adjacent sites.

Implementation of a CHASP and CAMP, and other controls including dust suppression and a truck inspection station to avoid off-Site tracking of soil, will prevent exposure due to soil migration off-Site in the form of dust, or on vehicle tires or equipment leaving the site during the remediation, excavation, and foundation construction stage of redevelopment. In addition, potential off-Site migration of Site soil contaminants is not expected to result in a complete exposure pathway for current, construction and remediation, or future conditions for the following reasons:

- The Site is located in an urban area and predominantly covered with continuous relatively impervious surface covering (i.e., building foundations and concrete paving)
- During Site redevelopment remediation and construction, the following protective measures will be implemented:
    - A Site-specific HASP including a CAMP will be implemented to protect on-Site personnel and to monitor the perimeter of the site to mitigate off-Site migration of particulates and VOCs during construction.
    - Air monitoring will be conducted for particulates (i.e., dust) and VOCs during intrusive activities as part of a CAMP. Dust and/or vapor suppression techniques will be employed to limit potential for off-Site migration of soil and vapors.
    - Vehicle tires and undercarriages will be washed as necessary prior to leaving the Site to prevent tracking material off-Site.
    - A soil erosion/sediment control plan will be implemented during construction to control off-Site migration of soil.

7.7 Evaluation of Human Health Exposure

Complete exposure pathways have the following five elements: 1) a contaminant source; 2) a contaminant release and transport mechanism; 3) a point of exposure; 4) a route of exposure; and 5) a receptor population.

Based upon the CSM and the review of environmental data, incomplete exposure pathways appear to be present under current conditions at the Site. Institutional and engineering controls will be implemented to prevent complete on-Site exposure pathways in construction/remediation and future conditions.

7.7.1 Current Conditions

Contaminant sources include contaminated historic fill with elevated levels of SVOCs, metals, and pesticides; PAHs and metals impacted soil and groundwater; soil and groundwater containing PFAS, and VOC-impacted soil vapor.

Contaminant release and transport mechanisms include contaminated soil transported as dust (dermal, ingestion, inhalation) and existing soil vapor contaminants (inhalation). Under current conditions, the likelihood of human exposure is unlikely, as Site access is restricted to employees, ownership and authorized personnel, and there will be multiple controls implemented through the HASP and CAMP to prevent any complete exposure pathway.

7.7.2 Construction/Remediation Activities

During remedial construction, institutional and engineering controls will be implemented to prevent complete on-Site exposure pathways. Potential points of exposure include disturbed and exposed soil during excavation and dust and organic vapors generated during soil excavation and off-Site disposal. Routes of exposure include ingestion and dermal absorption of contaminated soil, inhalation of organic vapors arising from contaminated soil, and inhalation of dust arising from contaminated soil. The receptor population includes construction and remediation workers. Members of the public, including employees of the adjacent Hong Ning Housing for the Elderly building who currently park vehicles on the Site, will not be allowed access once the remediation commences.

The potential for completed exposure pathways is present since all five elements exist; however, the risk will be minimized by limiting Site access and

through implementation of appropriate health and safety measures, such as monitoring the air for organic vapors and dust, using vapor and dust suppression measures, cleaning truck undercarriages before they leave the Site to prevent off-Site soil tracking, maintaining Site security, and wearing the appropriate personal protective equipment (PPE).

7.7.3 Proposed Future Conditions

Remedial construction is expected to remove all on-Site contaminants to a depth of approximately 18 feet below street level across the entire Site footprint. After construction, residual contaminants that may remain present below 18 feet below street level will be located beneath the currently anticipated building footprint. Contaminant release and transport mechanisms include penetrations through the building foundations and any remaining exposed soil in the unlikely event that any future excavation at that depth will occur following completion of the development. If protective measures and remediation are not implemented, points of exposure include potential cracks in the proposed building foundation and exposure during any future deep soil-disturbing activities. Routes of exposure may include inhalation of vapors entering the buildings or dust during any soil-disturbing work. The receptor population includes the building tenants, property employees, visitors and maintenance workers. However, the possible routes of exposure will be avoided or mitigated by proper installation of soil vapor mitigation measures and implementation of a Site Management Plan.

7.7.4 Human Health Exposure Assessment Conclusions

1. Under current conditions, there is a marginal risk for exposure which has been mitigated by limiting Site access, avoiding dermal contact with the soil on the Site through fencing and signage, and implementing the appropriate health and safety and vapor and dust suppression measures outlined in a Site-specific HASP and CAMP during ground-intrusive activities. The potential exposure pathways are for dermal contact, ingestion and inhalation of soil or soil vapor by employees of the adjacent building parking vehicles on the Site in the unlikely scenario where they would bypass the fencing and signage to touch the landscaped areas, personnel completing site investigations for redevelopment purposes, and other authorized personnel. Tenant access is currently restricted to the concrete patio where no exposed soil is present. Tenant access to the landscaped area around the patio has been restricted by temporary fencing and to all other

landscaped areas via posted notification/signage. Potential exposure to groundwater is limited to those completing investigation activities.

2. During construction and remediation activities exposure pathways will be avoided or minimized performing community air monitoring and by following the appropriate health and safety plans, implementing vapor and dust suppression techniques, and using Site security to control access. Implementation of the HASP will prevent the following primary exposure pathways:
    a. Dermal contact, ingestion and inhalation of contaminated soil, groundwater, or soil vapor by Site visitors and construction and remediation workers.
    b. Dermal contact, ingestion and inhalation of soil (dust) and inhalation of soil vapor by the community in the vicinity of the Site.
3. During remedial construction, Site access will be limited to authorized personnel and workers, and protective measures will be used during construction to prevent migration of Site contaminants to off-Site human receptors, including following a Site-specific HASP and implementation of a CAMP. Members of the public, including employees of the adjacent Hong Ning Housing for the Elderly building who currently park vehicles on the Site, and tenants who currently access the patio area, will not be allowed access once the remediation commences.
4. The existence of a complete exposure pathway for Site contaminants to human receptors during proposed future conditions is unlikely, as the majority of on-Site sources of contamination will be excavated and transported for off-Site disposal. Regional groundwater is not used as a potable water source in this part of New York City. It is not anticipated that dewatering will be required; the proposed building is not expected to be set within the groundwater table, which will minimize exposure to groundwater. The potential pathway for soil vapor intrusion into the buildings will be minimized for occupied portions of the building basement by a passive sub-slab depressurization system with a vapor barrier sealing layer.

8.0 NATURE AND EXTENT OF CONTAMINATION

This section evaluates the nature and extent of soil, groundwater and soil vapor contamination. The nature and extent of the contamination is derived from a combination

of field observations, historical analytical data from the 2019 portion of the RI, and analytical data from the 2020 portion of the RI that was discussed in Section 6.6.

8.1 Soil Contamination

Acetone was detected from 0 to 22 feet bgs exceeding the NYSDEC Unrestricted Use SCO in seven surficial samples and nine soil samples throughout the site during the RI activities completed in 2020. No other VOCs were detected in soil at concentrations exceeding the Unrestricted Use SCOs, Restricted Residential RUSCOs, or Protection of Groundwater SCOs during the 2019 and 2020 investigations.

SVOCs commonly associated with the presence of historic fill material including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, were detected from 0 to 22 feet bgs in seven surficial soil samples and 16 soil samples collected throughout the Site footprint during the RI activities completed in 2020 and in six soil samples collected during the 2019 investigation at concentrations exceeding the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs. These SVOCs were also detected from 0 to 20 feet in 11 composite soil waste characterization samples collected during the 2019 investigation.

Metals including arsenic, barium, cadmium, trivalent chromium, copper, lead, mercury, nickel, silver, and zinc were detected from 0 to 22 feet bgs in 10 surficial soil samples and 19 soil samples collected throughout the Site footprint during the 2020 RI and 11 soil samples collected during the 2019 investigation at concentrations exceeding Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs. These metals were also detected from 0 to 20 feet in 18 composite soil waste characterization samples collected during the 2019 investigation.

Pesticides including 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin were detected from 0 to 22 feet bgs at concentrations exceeding the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in 12 surficial soil samples and 6 samples collected during the 2020 RI and seven soil samples collected during the 2019 investigation. These pesticides were also detected from 0 to 20 feet in 14 composite soil waste characterization samples collected during the 2019 investigation.

PCBs and herbicides were not detected above the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs in any of the samples collected.

PFAS compounds were detected in all eleven surficial soil samples collected, four of the five soil samples collected from 0 to 2 feet bgs for which it was analyzed, and in all five soil samples collected from 20 to 22 feet bgs for which it was analyzed. The sources of PFAS contamination may be related to the two former laundry services on-Site, impacts caused to the Site from firefighting runoff from building materials when a fire occurred at the adjacent synagogue site, or an unidentified off-site source.

Soil sample analytical results exceeding the Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs for SVOCs, pesticides, and metals were detected throughout the Site and are generally attributed to the presence of a contaminated historic fill layer observed up to 30 feet in depth at the Site.

8.2 Groundwater Contamination

Groundwater sample analytical results did not identify the presence of pesticides, herbicides, or PCBs at concentrations above the SGVs in samples collected during the 2020 RI or 2019 investigation. The VOC chloroform was detected in one groundwater sample (LMW-8) collected in the eastern portion of the site during the 2020 RI. SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd) were detected at concentrations exceeding the SGVs in one groundwater sample (LMW-10) collected in the southeastern part of the site during the 2020 RI; however, these results are attributable to elevated turbidity during sample collection. Metals including iron, lead, magnesium, dissolved magnesium, manganese, dissolved manganese, nickel, selenium, dissolved selenium, dissolved selenium, sodium, and dissolved sodium were detected in groundwater at concentrations exceeding the SGVs during the 2020 RI and 2019 investigation. Groundwater analytical results exceeding the SGVs for metals were detected throughout the site and are attributed to naturally occurring background concentrations and elevated turbidity during sample collection. PFAS compounds were detected in all groundwater samples collected. The sources of PFAS contamination may be related to the two former laundry services on-Site, impacts caused to the Site from firefighting runoff from building materials when a fire occurred at the adjacent synagogue site, or an unidentified off-site source.

8.3 Soil Vapor Contamination

Soil vapor samples collected during the 2020 RI revealed TCE and PCE at concentrations above the respective monitoring and/or mitigation threshold in three samples in the northwestern and western areas of the site. RI soil vapor sample analytical results also identified elevated concentrations of petroleum-related VOCs including BTEX, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene throughout the Site footprint. Soil vapor analytical results from the 2019 investigation included petroleum-related VOCs throughout the Site footprint; no chlorinated VOCs were detected above the monitoring and/or mitigation thresholds. The presence of chlorinated VOCs and petroleum-related VOCs may be attributable to releases associated with historical site operations; however, as these compounds were not detected at notable concentrations in soil or groundwater at the Site, the presence of elevated concentrations of these compounds in soil vapor may also be attributable to an offsite source.

9.0 CONCLUSIONS

Stratigraphy: A historic fill layer as deep as 30 feet is underlain by a layer of native sand with varying amounts of silt and gravel. Bedrock was not encountered in any of the soil borings advanced during the previous investigation or this RI.

Hydrogeology: Depth to groundwater ranges from about 22.65 to 27.54 (corresponding to between el 5.35 and el 8.93 NAVD88) feet below current Site grade. Based on the groundwater elevations recorded during the 2020 RI, groundwater flows to the south.

Historic Fill Quality: Up to 30 feet of fill material was identified below surface cover. Contaminants related to historic fill material include SVOCs, metals, and pesticides, which were detected at concentrations above Unrestricted Use SCOs, Restricted Residential RUSCOs, and/or Protection of Groundwater SCOs within this layer.

Groundwater Quality: Groundwater analytical results exceeding the SGVs for metals were detected throughout the site and VOC and SVOC exceedances were detected at select well locations. Groundwater analytical results exceeding the SGVs for metals and SVOCs are attributed to naturally occurring background concentrations and elevated turbidity during sample collection.

Soil Vapor Quality: Results of the soil vapor evaluation completed as part of the RI identified concentrations of PCE and TCE that would require monitoring and/or mitigation per the NYSDOH guidance values.

Sufficient analytical data were gathered during the RI and previous studies to establish soil cleanup levels and to develop a remedy for the Site. The final remedy will be detailed in the forthcoming Remedial Action Work Plan (RAWP) to be prepared in accordance with NYS BCP guidelines. The remedy will need to address contaminated historic fill impacted with SVOCs, metals, and pesticides and VOC-impacted soil vapor.